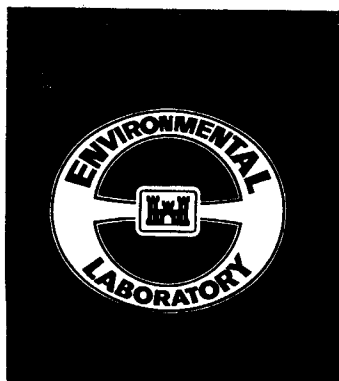
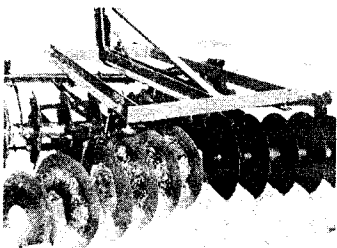




**US Army Corps
of Engineers**



ENVIRONMENTAL IMPACT RESEARCH PROGRAM

TECHNICAL REPORT EL-86-47

MANURE SPREADERS

Section 8.3.2, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

by

Ted B. Doerr

Environmental Laboratory

DEPARTMENT OF THE ARMY
Waterways Experiment Station, Corps of Engineers
PO Box 631, Vicksburg, Mississippi 39180-0631



July 1986

Final Report

Approved For Public Release; Distribution Unlimited

Prepared for DEPARTMENT OF THE ARMY
US Army Corps of Engineers
Washington, DC 20314-1000
Under EIRP Work Unit 31631

Destroy this report when no longer needed. Do not return
it to the originator.

The findings in this report are not to be construed as an official
Department of the Army position unless so designated
by other authorized documents.

The contents of this report are not to be used for
advertising, publication, or promotional purposes.
Citation of trade names does not constitute an
official endorsement or approval of the use of
such commercial products.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

| REPORT DOCUMENTATION PAGE | | | | Form Approved OMB No. 0704-0188 Exp. Date: Jun 30, 1986 | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------|
| 1a. REPORT SECURITY CLASSIFICATION Unclassified | | | 1b. RESTRICTIVE MARKINGS | | |
| 2a. SECURITY CLASSIFICATION AUTHORITY | | | 3. DISTRIBUTION / AVAILABILITY OF REPORT | | |
| 2b. DECLASSIFICATION / DOWNGRADING SCHEDULE | | | Approved for public release; distribution unlimited. | | |
| 4. PERFORMING ORGANIZATION REPORT NUMBER(S) Technical Report EL-86-47 | | | 5. MONITORING ORGANIZATION REPORT NUMBER(S) | | |
| 6a. NAME OF PERFORMING ORGANIZATION USAEWES Environmental Laboratory | | 6b. OFFICE SYMBOL (If applicable) | 7a. NAME OF MONITORING ORGANIZATION | | |
| 6c. ADDRESS (City, State, and ZIP Code) PO Box 631 Vicksburg MS 39180-0631 | | | 7b. ADDRESS (City, State, and ZIP Code) | | |
| 8a. NAME OF FUNDING / SPONSORING ORGANIZATION US Army Corps of Engineers | | 8b. OFFICE SYMBOL (If applicable) | 9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER | | |
| 8c. ADDRESS (City, State, and ZIP Code) Washington, DC 20314-1000 | | | 10. SOURCE OF FUNDING NUMBERS | | |
| | | | PROGRAM ELEMENT NO. | PROJECT NO. | TASK NO. |
| | | | WORK UNIT ACCESSION NO. ETRP 31631 | | |
| 11. TITLE (Include Security Classification) Manure Spreaders: Section 8.3.2, US Army Corps of Engineers Wildlife Resources Management Manual | | | | | |
| 12. PERSONAL AUTHOR(S) Doerr, Ted B. | | | | | |
| 13a. TYPE OF REPORT Final report | | 13b. TIME COVERED FROM _____ TO _____ | | 14. DATE OF REPORT (Year, Month, Day) July 1986 | |
| | | | | 15. PAGE COUNT 11 | |
| 16. SUPPLEMENTARY NOTATION Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. | | | | | |
| 17. COSATI CODES | | | 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) | | |
| FIELD | GROUP | SUB-GROUP | | | |
| | | | Applicators Manure spreaders Spreader | | |
| | | | Conveyer Site reclamation | | |
| | | | Equipment Fertilizer | | |
| 19. ABSTRACT (Continue on reverse if necessary and identify by block number) An equipment report on manure spreaders is provided as Section 8.3.2 of the US Army Corps of Engineers Wildlife Resources Management Manual. The report is designed to assist the Corps District or project biologist with the selection and use of types of equipment and materials available for habitat development and manipulation. Topics covered include description, operation and maintenance, limitations, and availability. Manure spreaders are modified single- and dual-axle trailers designed to apply manure and other organic solids to the soil. They are widely used for agriculture and reclamation where soils need more intensive renovation than can be provided by single tillage and inorganic amendments. Management objectives for using manure spreaders are stated, and applications to habitat development projects are discussed. The design and assembly of equipment are described and illustrated, and general specifications are provided. Methods of operation are described, and maintenance and safety requirements are given. Appropriate cautions and limitations are discussed. | | | | | |
| 20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS | | | 21. ABSTRACT SECURITY CLASSIFICATION Unclassified | | |
| 22a. NAME OF RESPONSIBLE INDIVIDUAL | | | 22b. TELEPHONE (Include Area Code) | | 22c. OFFICE SYMBOL |

PREFACE

This work was sponsored by the Office, Chief of Engineers (OCE), US Army, as part of the Environmental Impact Research Program (EIRP), Work Unit 31631, entitled Management of Corps Lands for Wildlife Resource Improvement. The Technical Monitors for the study were Dr. John Bushman and Mr. Earl Eiker, OCE, and Mr. Dave Mathis, Water Resources Support Center.

This report was prepared by Mr. Ted B. Doerr, Range Science Department, Colorado State University, Fort Collins, Colo. Mr. Doerr was employed by the Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES), under an Intergovernmental Personnel Act contract with Colorado State University during the period this report was prepared. Mr. Chester O. Martin, Team Leader, Wildlife Resources Team, Wetlands and Terrestrial Habitat Group (WTHG), EL, was principal investigator for the work unit. Information on spreaders was provided by personnel from AVCO New Idea Farm Equipment, Coldwater, Ohio; John Deere Company, Moline, Ill.; Schwartz Manufacturing, Lester Prairie, Minn.; and Sperry New Holland, New Holland, Penn. Review and comments were provided by Mr. Martin, WES, and Mr. Larry E. Marcy, Texas A&M University.

The report was prepared under the general supervision of Dr. Hanley K. Smith, Chief, WTHG, EL; Dr. Conrad J. Kirby, Chief, Environmental Resources Division, EL; and Dr. John Harrison, Chief, EL. Dr. Roger T. Saucier, WES, was Program Manager, EIRP. The report was edited by Ms. Jessica S. Ruff of the WES Information Products Division (IPD). Drawings were prepared by Mr. John R. Harris, Scientific Illustrations Section, IPD, under the supervision of Mr. Aubrey W. Stephens, Jr.

COL Allen F. Grum, USA, was the previous Director of WES. COL Dwayne G. Lee, CE, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.

This report should be cited as follows:

Doerr, Ted B. 1986. "Manure Spreaders: Section 8.3.2, US Army Corps of Engineers Wildlife Resources Management Manual," Technical Report EL-86-47, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

NOTE TO READER

This report is designated as Section 8.3.2 in Chapter 8 -- EQUIPMENT, Part 8.3 -- SOIL AMENDMENT EQUIPMENT, of the US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL. Each section of the manual is published as a separate Technical Report but is designed for use as a unit of the manual. For best retrieval, this report should be filed according to section number within Chapter 8.

MANURE SPREADERS

Section 8.3.2, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

| | | | |
|-----------------------|---|----------------------------|---|
| DESCRIPTION | 3 | LIMITATIONS | 5 |
| OPERATION | 5 | AVAILABILITY | 7 |
| MAINTENANCE | 5 | LITERATURE CITED | 8 |

Manure spreaders are designed to apply manure and other organic solids to the soil surface. They are rectangular-shaped trailers pulled by a 30- to 100-hp tractor (Larson 1980, Sperry New Holland 1983). Manure and organic matter applications are used to improve soil aeration, water-holding capacity, fertility, and organic matter content to enhance plant establishment and growth. Spreaders are used throughout the United States for agriculture and reclamation where soils need more intensive renovation than can be provided by simple tillage and inorganic amendments.

DESCRIPTION

Manure spreaders are modified single- and dual-axle trailers with solid sides. The bottom is a conveyor belt (apron) that moves material toward the rear, where the rotary flails beat, break up, and distribute the organic solid (Fig. 1). The bottom flail mechanism is either a large drum with short replaceable teeth or a thin drum or shaft with large replaceable teeth. The optional upper flail is also a thin drum with large replaceable teeth (Schwartz Manufacturing 1983; John Deere Company 1983). Some manure spreaders have a third optional "wide spread" flail to facilitate even spreading of organic material (Sperry New Holland 1983). Flails and conveyors are usually powered by power-take-off (PTO) systems. The John Deere 450 Hydra-push spreader uses a hydraulically powered push board to move organic material to the rear of the trailer. This reduces cleanup and maintenance requirements (John Deere Company 1983).

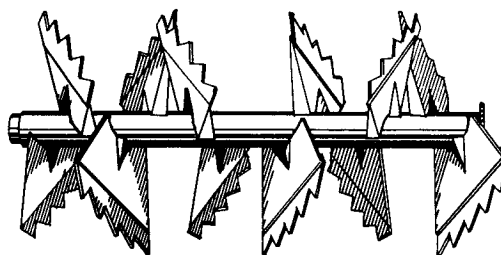
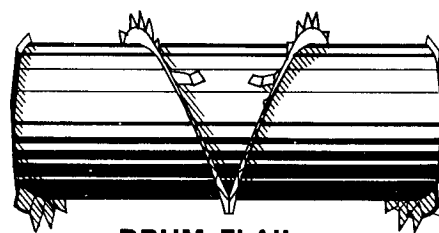
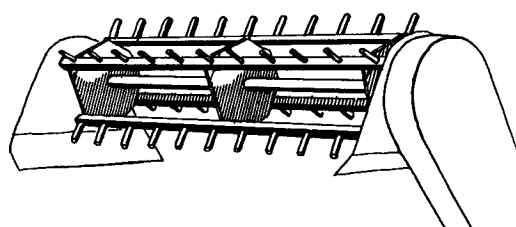
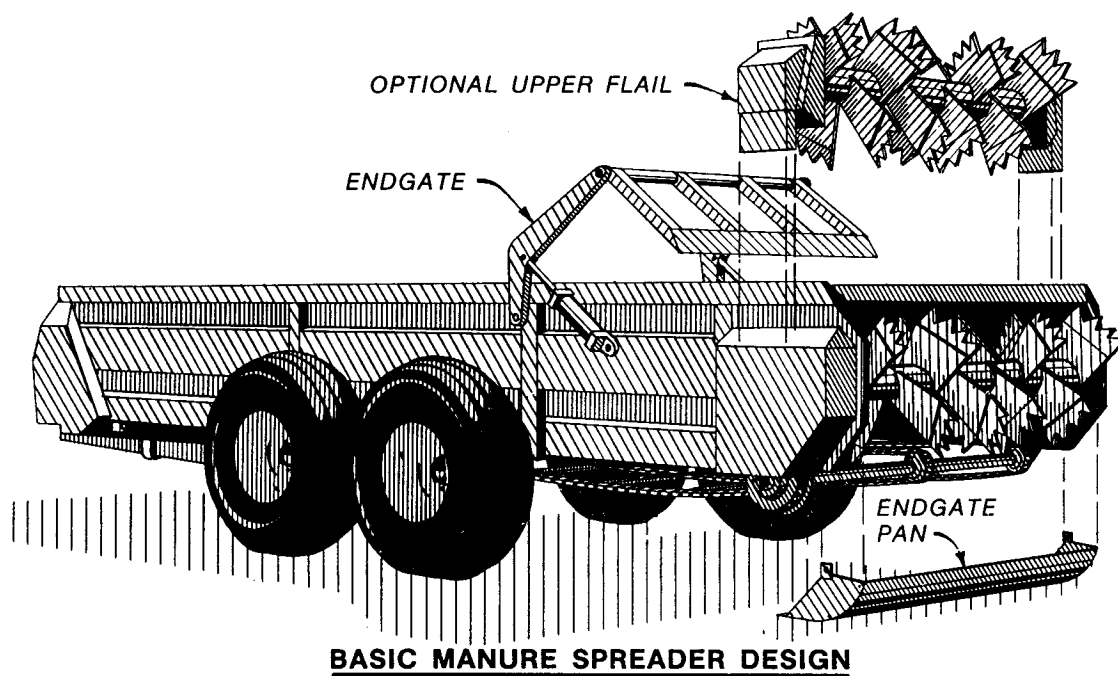


Figure 1. Basic manure spreader design, showing flail types available (adapted from materials provided by John Deere Company, AVCO New Idea, and Sperry New Holland)

Trailers vary in size, and load capacities range from 64 cu ft (Larson 1980) to 570 cu ft (Sperry New Holland 1983). Endgates allow fluid manure and solid organic material to be loaded off-site and transported to the treatment area with minimal material loss. A detachable slurry pan located beneath the bottom flail can be used to improve distribution of more fluid material (Fig. 1). Further specifications are presented in Table 1.

OPERATION

The manure spreader is loaded by a front-end loader or conveyor system at a material storage pile. The material is moved to the flails at the rear of the spreader by a conveyor belt or push panel. The application rate is determined by the speed of the tractor and the speed of the conveyor belt moving the material. Spreaders should be calibrated to ensure accurate application rates before use. Most manure spreaders have variable conveyor speeds. Material can either be left on the soil surface, crimped (to keep in place), or incorporated into the soil by rototilling or disking.

Application of organic material with high levels of wood residue may create an imbalance in the carbon-nitrogen ratio. This imbalance will limit plant-available nitrogen. Therefore, higher rates of nitrogen fertilizer may be required than estimates based on soil tests. If sewage sludge is being applied, nutrient levels, cation-exchange capacity, electrical conductivity, and heavy metal levels should be measured prior to use. These tests will show nutrient deficiencies, salt levels, and toxic substances detrimental to vegetation establishment.

MAINTENANCE

Manure spreaders should be cleaned after each use. Conveyors, chains, flail teeth, and PTO systems should be checked and repaired following manufacturers' specifications. Periodic lubrication of moving parts is required.

LIMITATIONS

Manure spreaders are not adapted for use on areas with rough topography, shallow rocky soils, or brush. Site preparation techniques (brush control, disking, etc.) need to be applied before manure spreaders can be used on these sites. For most projects, rotary spreaders are more useful than manure

Table 1. Specifications for several brands of manure spreaders

| Feature | Brand | | | | |
|-------------------------|---------------------------------------|-------------------------------------------------------|---------------------------------------|-----------------------------------------------------------------|---------------------------------------|
| | Deere Hydra-push | John Deere | Schwartz | Sperry New Holland | AVCO New Idea |
| Box capacity | | | | | |
| Struck | 142 cu ft | 77-245 cu ft | 76-203 cu ft | 71-340 cu ft | 84-356 cu ft |
| Heaped | 286 cu ft | 178-471 cu ft | 154-368 cu ft | 139-570 cu ft | 174-596 cu ft |
| Dimensions (overall) | | | | | |
| Width | 7.9 ft | 6.8- 9.0 ft | 5.7- 8.0 ft | 6.5-10.3 ft | 7.3-10.7 ft |
| Length | 19.3 ft | 16.6-24.6 ft | 15.6-23.2 ft | 14.7-26.3 ft | 16.0-24.8 ft |
| Height | 4.4 ft | 3.8- 4.4 ft | 3.7- 5.8 ft | 3.8- 6.9 ft | 4.7- 6.8 ft |
| Conveyor speed settings | multiple | 1-3 | 2 or 7 | 2 plus | 1 or 5 |
| Operation speed | 5-6 mph | 5-6 mph | 3-6 mph | 5 mph | 5 mph |
| Power requirements | 60 hp | 50-80+ mph | 30-85 hp | 20-135 hp | 40-125 hp |
| Attachments | Upper flail Endgate Endgate pan | Upper flail Endgate Endgate pan Flail shield | Upper flail Endgate Endgate pan | Upper flail Endgate Endgate pan "Wide spread" flail | Upper flail Endgate Endgate pan |

spreaders unless the site requires organic amendments to restore productivity; large quantities of organic material must also be available.

AVAILABILITY

Manure spreaders and associated equipment are available from the following retailers:

AVCO
New Idea Farm Equipment
420 S. First Street
Coldwater, Ohio 45828

John Deere Company
John Deere Road
Moline, Illinois 61265

Ford Tractor Operations
2500 E. Maple Road
Troy, Michigan 48024

Gehl Company
143 E. Water Street
West Bend, Wisconsin 53095

International Harvester
Agricultural Equipment Div.
401 N. Michigan Avenue
Chicago, Illinois 60611

Schultz Manufacturing Company
P. O. Box 388
Waterloo, Iowa 50704

Schwartz Manufacturing
P. O. Box 248
Lester Prairie, Minnesota 55354

Sperry New Holland
500 Diller Avenue
New Holland, Pennsylvania 17557

LITERATURE CITED

- John Deere Company. 1983. Loaders, spreaders, and rear blades. Specification sheet, Moline, Ill. 43 pp.
- Larson, J. E. 1980. Revegetation equipment catalogue. USDA For. Serv. Equipment Development Center, Catalogue No. 8042 2501. 198 pp.
- Schwartz Manufacturing. 1983. Manure spreaders. Specification sheet. Lester Prairie, Minn. 5 pp.
- Sperry New Holland. 1983. Box spreaders. Specification sheet. New Holland, Penn. 5 pp.